U. S. FOREST SERVICE

RESEARCH NOTE NC-97

NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE

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Is Cull Overestimated in Northern Hardwood Stands?

ABSTRACT. — To determine whether overestimated cull could partly explain differences between bid offers and appraised values of northern hardwood timber, cull volume estimated by the accepted method was compared with actual cull volume measured from flitch photographs and log-scaled cull volume.
OXFORD: 525.5(774):176.1 *Acer saccharum*

Bid offers for northern hardwood timber are often much higher than appraised values. Possible explanations are underestimated tree volume or quality, and overestimated cull volume. This paper deals only with the possibility of overestimated cull.[1]

The Zillgitt and Gevorkiantz method (1946) is currently used to estimate cull in northern hardwood stands.[2] This method relates defects such as dead limbs, conks, cracks, crook, and sweep to cull volume percentage. The defect types are grouped according to severity. This severity classification and the number of 16-foot logs per tree determines cull percentage.

We used the Zillgitt and Gevorkiantz method to calculate average cull percentage for sugar maple (*Acer saccharum* Marsh.) trees, and then compared this value with cull volume measured (1) from flitch photographs and (2) from log-scaled volume, using log exterior and end photographs. The Zillgitt and Gevorkiantz method overestimated cull by about four times in our sample trees.

METHODS

Sample trees were cut in old-growth sugar maple stands in Upper Michigan. These trees were selected by d.b.h. and the number of clear faces within the butt one-quarter of the merchantable stem.[3] Trees were separated into three d.b.h. classes, and three quality classes within each d.b.h. class. The d.b.h. classes were 11 to 15 inches, 16 to 20 inches, and 21 to 26 inches; the quality classes were 0 to 1 clear faces, 2 clear faces, and 3 to 4 clear faces. There were 10 trees in each d.b.h.-quality class combination, for a total of 90 trees. Tree age ranged from 92 to 289 years, averaging 192; d.b.h. averaged 18 inches.

[1] *Includes sound (crook and sweep) and unsound cull volume.*

[2] *Actually, Zillgitt's (1946) four-class system is used, but the six-class system referenced above is identical except for more detail.*

[3] *The merchantable height was restricted by a 6-inch d.i.b. minimum top or separation of the stem into two or more distinct branches.*

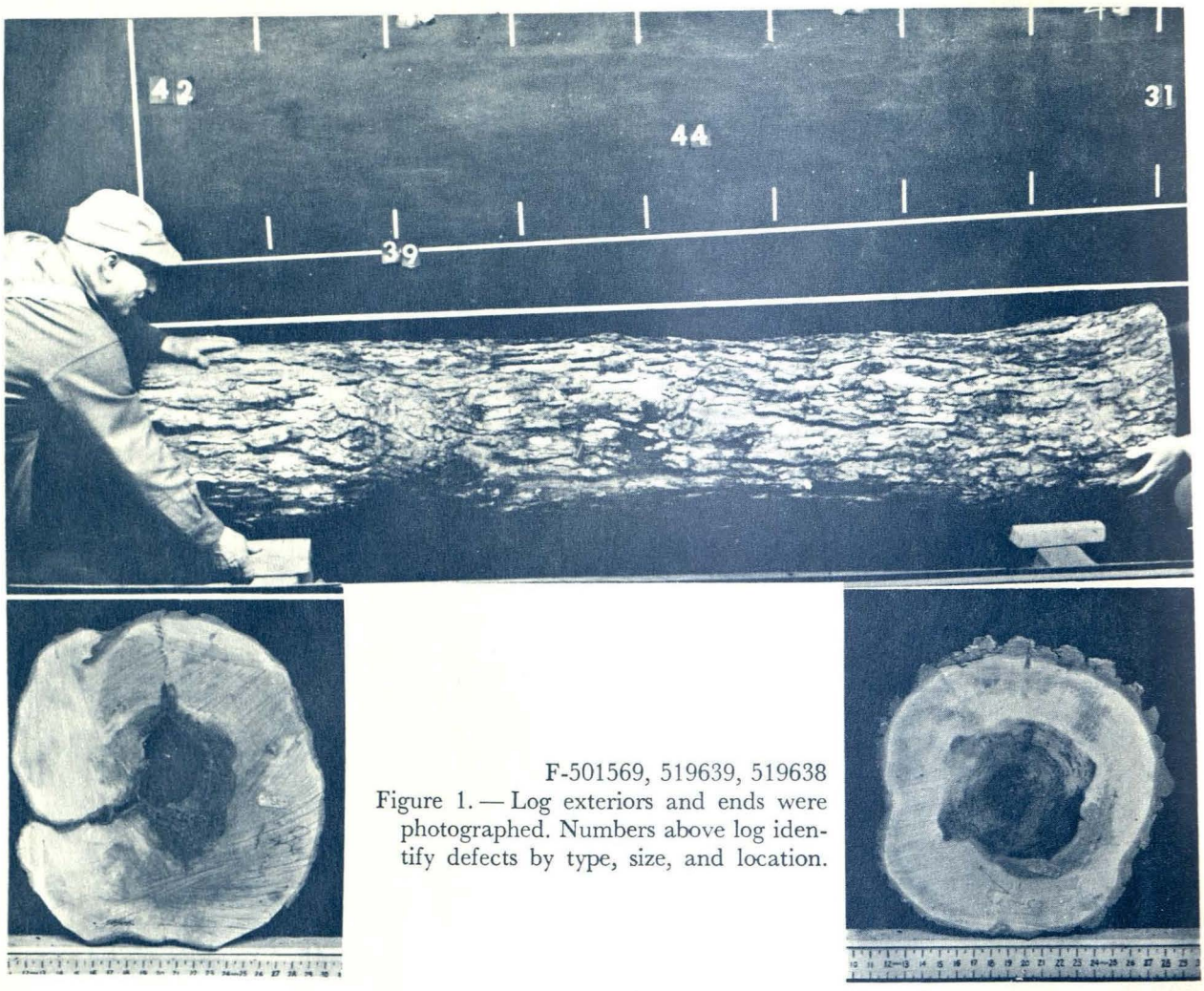

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Figure 1. — Log exteriors and ends were photographed. Numbers above log identify defects by type, size, and location.

The trees were felled and bucked, all surface abnormalities (defects) found on each log identified and measured, and log exteriors and ends photographed (fig. 1). The logs were then sawed through-and-through into 1-inch-thick flitches, unsound cull areas outlined, and flitches photographed (fig. 2).

Cull volume by the Zillgitt and Gevorkiantz Method. — The log exterior and end photographs were used to paper-diagram each tree, showing the type, size, and location of all defects. We used these diagrams and table 2

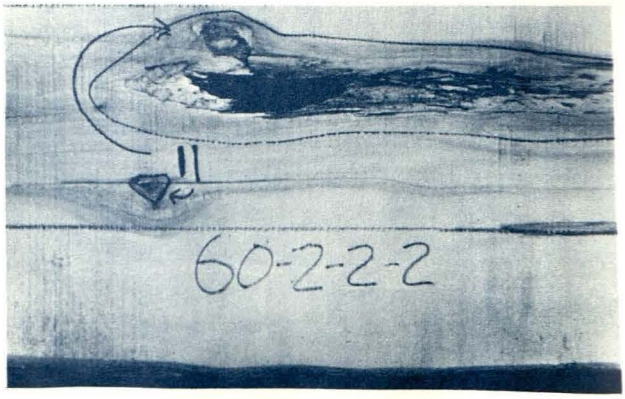

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Figure 2. — Unsound cull areas were marked on each flitch and all flitches photographed.

from Zillgitt and Gevorkiantz (1946) to determine defect classes for each tree. The defect classes and the number of 16-foot logs per tree were then used to calculate cull percentage for each tree.

Log-scaled cull volume. — In addition, the tree paper-diagrams and log grades (Vaughan *et al.* 1966) were used to simulate bucking each tree into logs, which were log-scaled using Grosenbaugh's (1952) formulas.[4] Log cull volumes were then summed to determine cull volume per tree.

Cull volume measured from flitch photographs. — Unsound cull volume was measured for each tree by summing the squared-out cull areas on each flitch photograph (fig. 3). To get total cull volume per tree, these unsound cull volumes were added to the sound cull volumes obtained by log scaling as described above.

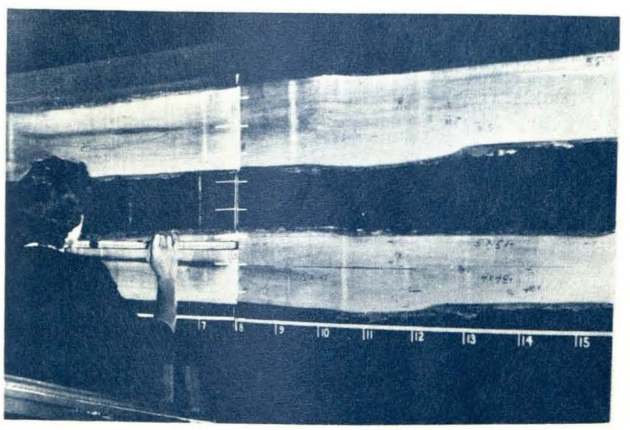

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Figure 3. — Flitch photographs were projected onto a screen and unsound cull areas measured.

The average cull percentages calculated for the 90 trees by the three different methods, the Zillgitt and Gevorkiantz, log scaling, and flitch measuring, were then compared.

[4] *These formulas are the same as those given in the National Forest Log Scaling Handbook except they are expressed as a percentage of log volume.*

RESULTS AND DISCUSSION

The cull volume percentage from the Zillgitt and Gevorkiantz method was about four times as large as that obtained from either log scaling or measuring from flitch photographs (table 1). This is in contrast to data published earlier (Zillgitt and Gevorkiantz 1946) showing the Zillgitt and Gevorkiantz method to underestimate cull by 5.3 percent of gross merchantable volume for sugar maple trees. However, Zillgitt and Gevorkiantz measured cull volume by log scaling in the field, whereas we log-scaled in the laboratory using photographs of log exteriors and ends.

Our results indicate that overestimated cull could partially account for the difference between appraised value and bid offers for northern hardwood timber.

LITERATURE CITED

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Zillgitt, W. M. 1946. A quick method of estimating cull in northern hardwood stands. USDA Forest Serv., Lake States Forest Exp. Sta. Tech. Note 255.

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Table 1. — *Comparison between estimated and measured cull*

Method used to determine total cull	Total cull for all 90 trees	Mean cull per tree	Standard deviation	Gross merchantable volume [1]
	Cu. ft.	Cu. ft.	Cu. ft.	Percent
Zillgitt and Gevorkiantz	1,133	12.7	11.8	26.2
Log scaling using photographs of log faces and ends	244	2.7	3.1	5.6
Measuring from flitch photographs [2]	266	3.0	4.1	6.2

1/ Total stem volume (Smalian) excluding tops and stumps.

2/ Sound cull was obtained by log scaling using Grosenbaugh's (1952) formulas for estimating crook and sweep. These values were then added to the flitch-measured unsound cull to get total cull.

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